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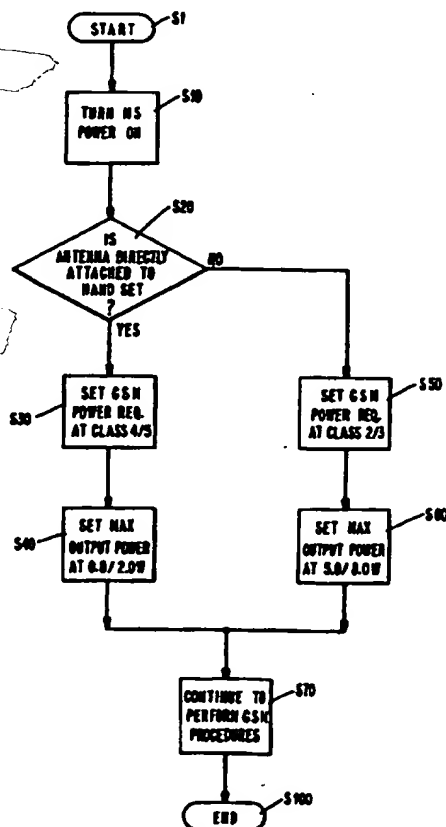
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(54) Title: ANTENNA GUIDED POWER CONTROL

(57) Abstract

A system and method are provided for controlling the output power from a mobile station based on the type of antenna used. The system and method detect whether the antenna is a type which is directly attached to an acoustic transducer for speech of the mobile station and controls the output transmission power based on this detection to conform with GSM requirements. More particularly, if the antenna is detected to be directly attached to the acoustic transducer for speech, and thereby to the hand set of the mobile station, the maximum output power of the mobile station is Class 4 or 5, which corresponds to 2.0 watts or 0.8 watts respectively, in order to comply with the GSM requirements. However, if the antenna of the mobile station is not detected to be directly attached to the acoustic transducer for speech, a higher maximum output power of the mobile station of Class 2 or 3, which corresponds to 5.0 watts or 8.0 watts respectively, is used by determining that an externally connected antenna is being used by the mobile station. As a result, the system and method control the output power of the mobile station to conform with the GSM requirements for the output power at a high accuracy.



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**ANTENNA GUIDED POWER CONTROL****BACKGROUND**

5       The present invention is directed to a method and system of controlling the output power from a mobile station based on the type of antenna used. More particularly, the method and system controls the output power in response to detecting whether the antenna is  
10 directly attached to an acoustic transducer for speech of the mobile station or whether the antenna is externally connected to the mobile station so that the output power of the mobile station conforms with GSM requirements.

It is desired to control the output power from a GSM  
15 terminal to conform with the GSM 02.06 requirements for a hand-held mobile station. The portions of GSM 02.06 directed to the output power requirements are included in sections 3.3-5, which are hereby incorporated by reference.

20       The GSM 02.06 requirements define a hand-held mobile station as "the station where the antenna can be directly attached to a portion of the equipment containing an acoustic transducer for speech." As defined in section 5 of the GSM 02.06 requirements, such hand-held mobile  
25 stations are only allowed to transmit at Class 4 or 5 which corresponds to a maximum output power of 2.0 W or 0.8 W.

However, a hand-held mobile station may be configured as a vehicle-mounted or portable station where the antenna  
30 is externally connected to the system and is not directly attached to a portion of the equipment containing the acoustic transducer for speech. In these stations with an externally connected antenna, the mobile station is allowed to transmit in any mobile station class such as  
35 Class 2 or 3 having a maximum output power of 5.0 W or 8.0 W for example. Even though a mobile station can

transmit at any power level when an external antenna is used, an output power of Class 2 or 3 is used to increase the chance of getting in contact with the cellular system. For instance, if the distance between radio base stations is large or if the mobile station user is inside a car or a building, there is actually no need for extra power because an external antenna can get "outside."

The present solution for controlling the output power a GSM terminal is either by using a man-made interface or by detecting the existence of an external power source. The man-made interface requires the user to recognize the necessary output power for conforming to GSM requirements and then to manually control an output power switch to properly control the output power. This system is very dependent upon the user and the output power will not be controlled properly if the user forgets to switch the output power or if the user is not knowledgeable of the output power requirements for conforming with the GSM requirements.

Another known system detects whether an external power source is present and switches the output power according to this detection. One example of this known system determines whether an external power source, such as a 12 volt car battery, supplies power to the mobile station and if such an external source is detected, it is assumed that an externally connected antenna is connected to the mobile station and the output power for transmitting is set to Class 2 or 3 which corresponds to 5.0 W or 8.0 W, respectively. This system only detects whether an external power source is present and does not specifically detect whether an antenna is directly attached to the mobile station at the acoustic transducer for speech. As a result, if an external power source fails to be detected, the output power from the GSM terminal will be lowered for transmitting at Class 4 or 5

(2.0 W or 0.8 W maximum output power). Thereby, a detection on whether the antenna is directly attached to the acoustic transducer for speech may not be accurately determined so that compliance is not made with the GSM requirements.

By failing to accurately control the output power during transmission from the GSM terminal and not conforming to the GSM requirements, many adverse conditions arise when using the mobile station. For example, if the output power from the mobile station does not conform to the GSM requirements, a hand-held mobile station may transmit at a high maximum output power. Because the power source of the hand-held mobile station is used in close proximity to the user when transmitting, it is desired to reduce the maximum output power as much as possible when transmitting due to the potential dangers to users from high output power. Also, if the output power from the mobile station does not conform to the GSM requirements, the probability of accessing external networks from the mobile station will decrease when a high output power is used to transmit from a confined area, such as a car for example, due to the electromagnetic properties of the transmitted radio waves. Furthermore, if a high output power is used by a hand-held mobile station inside of a car, the operation of the electronic control systems of the car may be adversely affected by high power radio transmission. Accordingly, a system and method which prevents the problems in known systems is desired so that the output power from a GSM terminal automatically and accurately conforms with GSM requirements.

#### SUMMARY

An object of the present invention is to provide a method and system of controlling the output power from a GSM terminal to conform with GSM requirements.

Another object of the present invention is to provide a method and system of controlling the output power from a mobile station by detecting whether an antenna of the mobile station is directly attached to an acoustic transducer for speech of the mobile station and then  
5 controlling the output power of the mobile station transmission based on this detection.

A still further object of the present invention is to detect the type of antenna that is used by the mobile  
10 station and controlling the output power for transmission between first and second output power levels based on this detection.

These objects of the present invention are fulfilled by providing a method of controlling the output power from  
15 a mobile station comprising the steps of detecting whether the antenna of the mobile station is directly attached to an acoustic transducer for speech of the mobile station and controlling the output power of the mobile station to transmit at a first maximum output power in response to  
20 the step of detecting. This method controls the output power from the mobile station to conform with the GSM requirements for output power transmission at a high accuracy. More particularly, this method transmits at a maximum output power of Class 4 or 5, which corresponds to  
25 2.0 W or 0.8 W respectively, when the antenna is directly attached to the acoustic transducer for speech of the mobile station and at a maximum output power of Class 2 or 3, which corresponds to 5.0 W or 8.0 W respectively, when the antenna is externally connected to the mobile station.

The objects of the present invention are also  
30 fulfilled by providing a system for controlling output power from a mobile station comprising an antenna for the mobile station, a detector for detecting whether said antenna is directly attached to an acoustic transducer for  
35 speech, and a controller for controlling the output power

of the mobile station to transmit at a first maximum output power in response to said acoustic transducer for speech being detected as directly attached to said antenna by said detector. This system also allows the output power from the mobile station to be controlled with high accuracy in order to conform with the GSM requirements.

Further scope of applicability of the present invention will become apparent from the detailed description given hereinafter. Although, it should be understood that the detailed description and specific examples, while indicating preferred embodiments of the invention, are given by way of illustration only, since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from this detailed description.

#### BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will become more fully understood from the detailed description given hereinbelow and the accompanying drawings which are given by way of illustration only, and thus are not limitative of the present invention, wherein:

Figure 1 illustrates a mobile station for an embodiment of the present invention;

Figure 2 illustrates a more detailed illustration of the radio unit for the mobile station illustrated in Figure 1; and

Figure 3 illustrates a flow chart for the output power control in an embodiment of the present invention.

#### DESCRIPTION

An embodiment of the present invention will be discussed with respect to Figure 1. Figure 1 illustrates a block diagram of the main functional units in a mobile station. These functional units include an operating unit 10, a control unit 20, a radio unit 30, a duplex filter 40

and an antenna 50. The operating unit 10 is controlled by a microprocessor and is generally incorporated in the hand set of the mobile station which includes an acoustic transducer for speech. The operating unit 10 includes at least features such as keypads and a display. The mobile station also includes a control unit 20 based on a microprocessor. If a handset is provided separate from the mobile station, two microprocessors must be used for the operating unit 10 and the control unit 20. However, if the handset is incorporated in the mobile station as one unit, a single microprocessor can be used for the operating unit 10 and the control unit 20.

The control unit 20 handles data signalling on the radio path according to known protocols and also controls the radio unit 30. The radio unit 30 performs the radio communication from the mobile station to other stations such as radio base stations for example. The main operating functions performed by the radio unit 30 are illustrated in Figure 2 and include a transmitter 32, a receiver 34 and a power amplifier 36. The mobile station also includes a duplex filter 40 that is connected to an antenna 50 and the duplex filter 40 allows for simultaneous transmission and reception by the antenna 50 on the radio path.

In order to conform to the GSM requirements for the output power, the control unit 20 controls the output power from the radio unit 30 based on the type of antenna detected. The detection of the type of antenna can be performed in various conventional ways. For example, mechanical, inductive, magnetic, etc. detection can be used. Also, the control unit 20 detects whether the antenna 50 is directly connected to the hand set of the mobile station or whether the antenna 50 is externally connected to the mobile station. If a hand-held mobile station is determined to have the operating unit 10, the



control unit 20, the radio unit 30 and the duplex filter 40 incorporated into a hand set and the antenna 50 is attached to this hand set so that the portion of the mobile station containing the acoustic transducer for speech is directly attached to the antenna 50, the hand-held mobile station is only allowed to transmit at a first maximum output power.

To comply with the GSM requirements for output power, this first maximum output power for transmission is of Class 4 or 5, which corresponds to 2.0 W or 0.8 W maximum output power. However, if the mobile station is configured as a vehicle mounted or a portable mobile station, the control unit 20 determines this condition and allows transmission in any mobile station class. When complying with GSM requirements, the mobile station is allowed to transmit at Class 2 or 3, which corresponds to 5.0 W or 8.0 W maximum output power.

Figure 3 illustrates a flow chart for the control of the output power of a GSM terminal that conforms to the GSM requirements for the output power. At step S10, the power for the mobile station is turned on. Next, step S20 determines whether or not the antenna 50 is directly attached to the hand set and thereby to the acoustic transducer for speech. If the antenna 50 is determined to be directly attached to the hand set, the operation proceeds to step S30 where the GSM power requirements are set to Class 4 or 5 and then to step S40 which sets the maximum output power from the radio unit at 0.8 W or 2.0 W. However, if the antenna 50 fails to be determined as directly attached to the hand set at step S20, the operation proceeds to step S50 where the GSM power requirements are set at Class 2 or 3 and then to step S60 where the maximum output power from the radio unit is set at 5.0 W or 8.0 W. After setting the maximum output power at either step S40 or S60, the operation proceeds to

step S70 where process continues and the known GSM procedures are performed.

The embodiments are directed to detecting whether the antenna is directly connected to the acoustic transducer for speech of the hand set because this is the critical issue in determining the maximum allowed output power for transmission by the mobile station. As a result, the output power is controlled by detecting the type of antenna that is used by the mobile station in order to conform with the GSM requirements for the output power. If a first type of antenna, such as an external antenna type, is used, then the mobile station is allowed to transmit at one maximum output power, such as Class 2 or 3 corresponding to 5.0 W or 8.0 W, in order to conform with the GSM requirements for the output power. If a second type of antenna is used, such as a type of antenna directly connected to the acoustic transducer of the hand set, the mobile station is allowed to transmit with another lower maximum output power, such as Class 4 or 5 corresponding to a maximum output power of 2 W or 0.8 W for example, in order to conform with the GSM requirements for the output power. Thereby, the output power from the GSM terminal is controlled with a high degree of accuracy to conform with the GSM requirements.

The invention being thus described, it will obvious that the same may be varied in many ways. Such variations are not to be regarded as a departure from the spirit and scope of the invention, and all such modifications as would be obvious to one skilled in the art are intended to be included within the scope of the following claims.

**CLAIMS:**

1. A method of controlling the output power from a mobile station, comprising the steps of:

5       (a) determining whether an antenna of the mobile station is directly attached to an acoustic transducer for speech or whether said antenna is externally connected to the mobile station; and

10       (b) controlling the output power of the mobile station in response to said step (a).

2. A method according to claim 1, wherein said step (b) controls the output power to transmit at a first maximum output power in response to said step (a) detecting said antenna to be directly attached to said acoustic transducer for speech and at a second maximum output power in response to said step (a) failing to detect said antenna as being directly attached to said acoustic transducer for speech.

3. A method according to claim 2, wherein said first maximum output power complies with GSM requirements, and is Class 4 or 5 which corresponds to 2.0 watts or 0.8 watts, respectively, and said second maximum output power complies with GSM requirements of Class 2 or 3, which corresponds to 5.0 watts or 8.0 watts, respectively.

4. A method according to claim 1, wherein said step (b) controls the output power to transmit at a first maximum output power in response to said step (a) detecting said antenna to be externally connected to the mobile station and at a second maximum output power in response to said step (a) failing to detect said antenna as being externally connected to the mobile station.

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5. A method according to claim 4, wherein said first maximum output power complies with GSM requirements, and is Class 2 or 3 which corresponds to 5.0 watts or 8.0 watts, respectively, and said second maximum output power  
5 complies with GSM requirements, and is Class 4 or 5 which corresponds to 2.0 watts or 0.8 watts, respectively.

6. A method of controlling output power from a mobile station to conform with GSM requirements comprising  
10 the steps of:

- (a) detecting between first and second types of antennas; and
- (b) controlling the output power of the mobile station to transmit at a first maximum output power when  
15 said first type of antenna is detected at said step (a) and at a second maximum output power when said second type of antenna is detected at said step (a).

7. A method according to claim 6, wherein said  
20 first type of antenna is directly connected to the mobile station at an acoustic transducer for speech and said second type of antenna is externally connected to the mobile station.

25 8. A method according to claim 7, wherein said first maximum output power is Class 4 or 5, which corresponds to 2.0 watts or 0.8 watts respectively, and said second maximum output power is Class 2 or 3, which corresponds to 5.0 watts or 8.0 watts, respectively.

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9. A method according to claim 6, wherein said first type of antenna is directly attached to the hand set of the mobile station and said second type of antenna is external to the hand set of the mobile station for use in

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a vehicle mounted or portable configuration of the mobile station.

10. A system for controlling output power from a  
5 mobile station to conform with GSM requirements comprising:

an antenna for the mobile station;

a detector for detecting whether said antenna is a  
first type or a second type; and

10 a controller for controlling the output power of the  
mobile station to transmit at a first maximum output power  
when said detector detects said first type of antenna and  
at a second maximum output power when said detector  
detects said second type of antenna.

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11. A system according to claim 10, wherein said  
first type of said antenna is directly connected to the  
mobile station at an acoustic transducer for speech and  
said second type of said antenna is externally connected  
20 to the mobile station.

12. A system according to claim 11, wherein said  
first maximum output power is Class 4 or 5, which  
corresponds to 2.0 watts or 0.8 watts respectively, and  
25 said second maximum output power is Class 2 or 3, which  
corresponds to 5.0 watts or 8.0 watts, respectively.

13. A system according to claim 10, further  
comprising:

30 an operating unit including keypads, a display  
and an acoustic transducer for speech;

a radio unit including a transmitter, receiver  
and power amplifier; and

a duplex filter connected to said antenna for simultaneously transmitting and receiving via said antenna on a radio path.

5        14. A system according to claim 13, wherein said detector, said controller, said operating unit, said radio unit and said duplex filter are incorporated into a hand set of the mobile station and said first type of said antenna is directly connected to said hand set.

10        15. A system according to claim 14, wherein said second type of said antenna is external to said hand set and is used in a vehicle mounted or portable configuration of the mobile station.

15        16. A system for controlling output power from a mobile station, comprising:  
         an antenna for the mobile station;  
         a detector for detecting whether said antenna is  
20        directly attached to an acoustic transducer for speech or whether said antenna is externally connected to the mobile station; and  
         a controller for controlling the output power of the mobile station in response to said detector.

25        17. A system according to claim 16, wherein said controller controls the output power to transmit at a first maximum output power in response to detecting said antenna as being directly attached to said acoustic  
30        transducer for speech by said detector and at a second maximum output power in response to failing to detect said antenna as being directly attached to said acoustic transducer for speech by said detector.

18. A system according to claim 16, wherein said first maximum output power complies with GSM requirements and is Class 4 or 5, which corresponds to 2.0 watts or 0.8 watts, respectively, and said second maximum output power complies with GSM requirements and is Class 2 or 3, which corresponds to 5.0 watts or 8.0 watts, respectively.

19. A system according to claim 16, wherein said controller controls the output power to transmit at a first maximum output power in response to detecting said antenna as being externally connected to the mobile station by said detector and at a second maximum output power in response to failing to detect said antenna as being externally connected to the mobile station by said detector.

20. A system according to claim 19, wherein said first maximum output power complies with GSM requirements, and is Class 2 or 3 which corresponds to 5.0 watts or 8.0 watts, respectively, and said second maximum output power complies with GSM requirements, and is Class 4 or 5 which corresponds to 2.0 watts or 0.8 watts, respectively.

21. A system according to claim 16, further comprising:

an operating unit including keypads, a display and said acoustic transducer for speech;

a radio unit including a transmitter, receiver and power amplifier; and

a duplex filter connected to said antenna for simultaneously transmitting and receiving via said antenna on a radio path.

22. A system according to claim 21, wherein said detector, said controller, said operating unit, said radio

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unit and said duplex filter are incorporated into a handset of the mobile station so that said antenna is directly attached to said acoustic transducer for speech via said hand set.

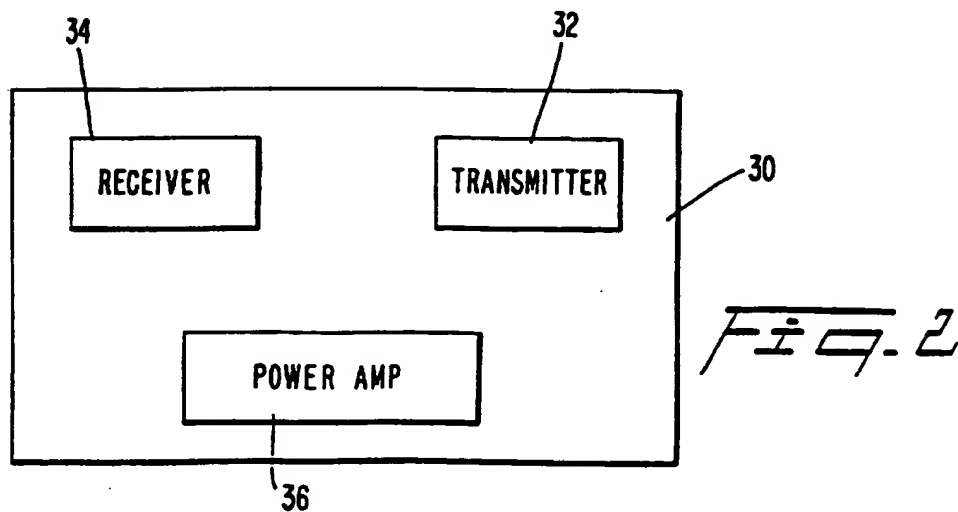
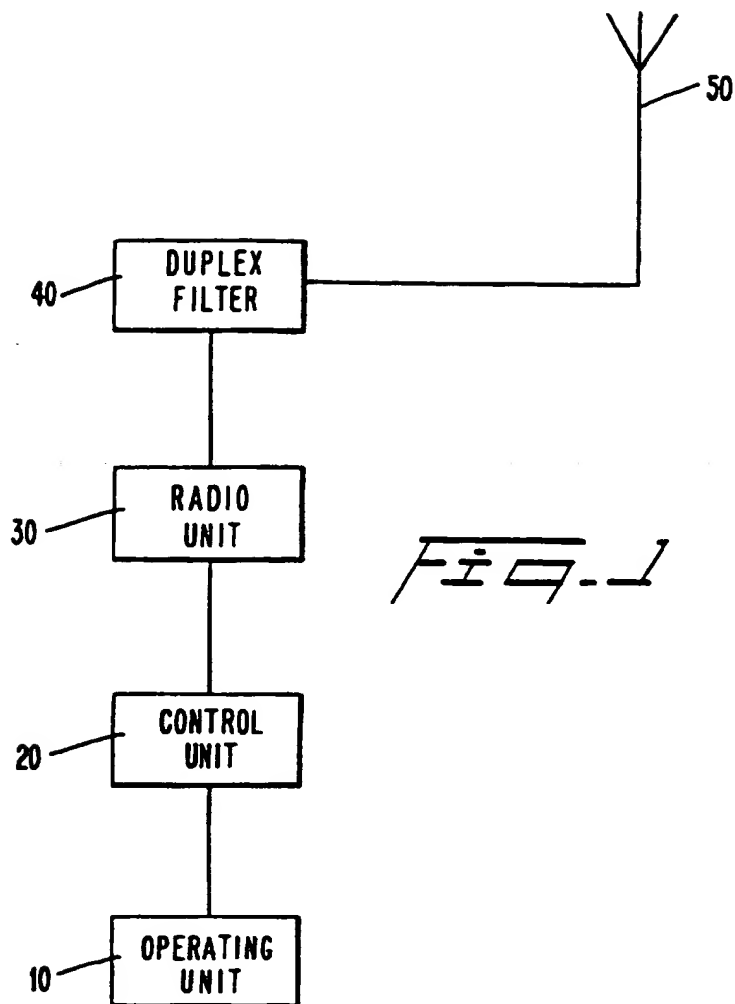
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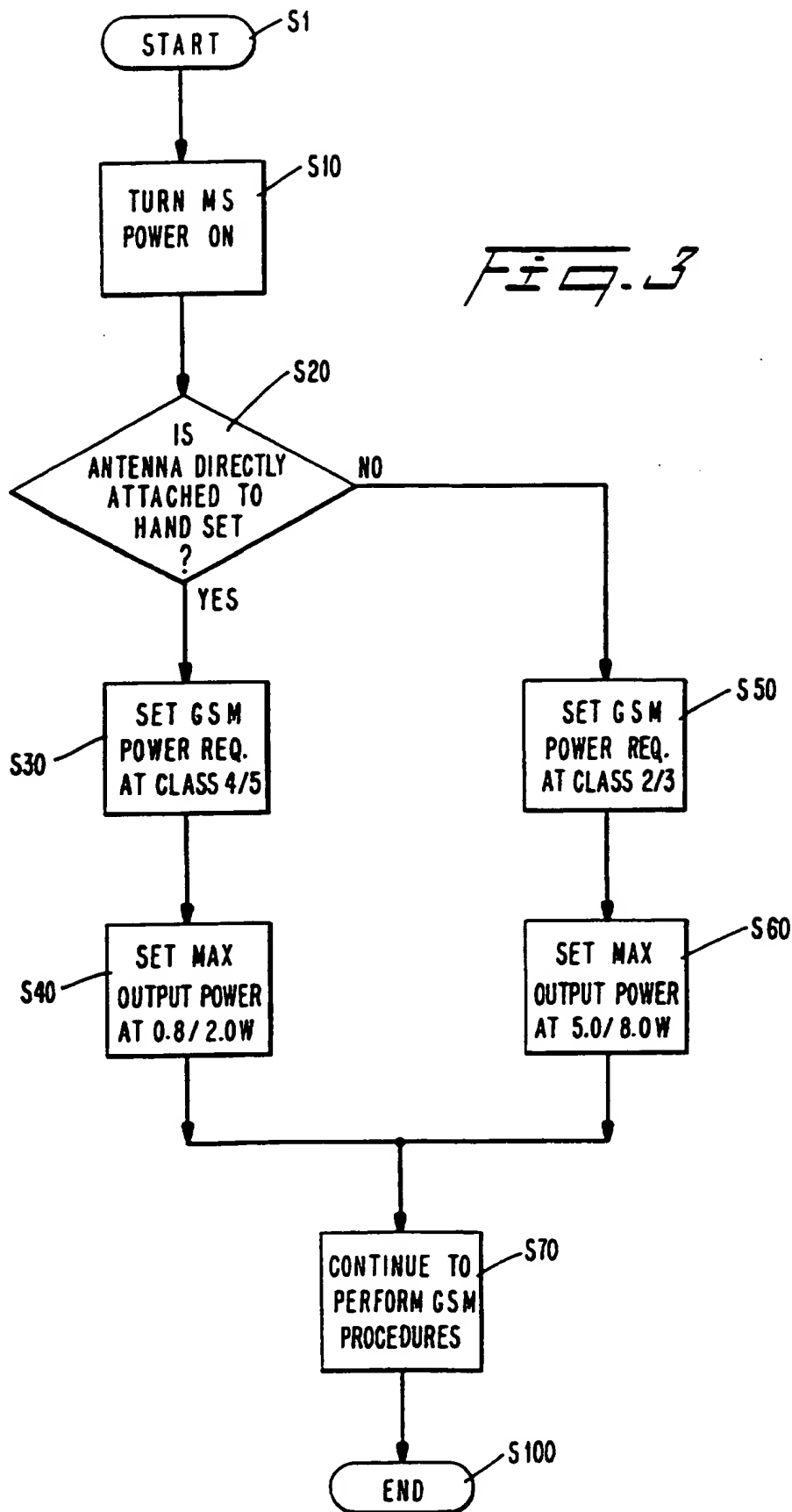
23. A system according to claim 21, wherein said second maximum output power corresponds to said antenna being externally connected to the mobile station for use in a vehicle mounted or portable configuration of the

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mobile station.







# INTERNATIONAL SEARCH REPORT

Intern al Application No  
PCT/SE 96/00555

A. CLASSIFICATION OF SUBJECT MATTER  
IPC 6 H04B1/38 H04Q7/32

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 H04B H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	MOTOROLA TECHNICAL DEVELOPMENTS, vol. 19, 1 June 1993, pages 25-26, XP000361458 FORD R ET AL: "METHOD FOR AUTOMATIC RF SWITCHING BASED ON PRESENCE OF ANTENNA" see page 25, left-hand column, line 1 - line 6 see right-hand column, line 3 - line 18; figures	1,10,16
A	EP,A,0 331 435 (TOKYO SHIBAURA ELECTRIC CO) 6 September 1989 see column 3, line 29 - column 4, line 9	1,10,16
A	US,A,4 636 741 (MITZLAFF JAMES E) 13 January 1987 see column 1, line 38 - line 60 see column 3, line 43 - column 4, line 15	1,10,16
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☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Date of the actual completion of the international search

23 July 1996

Date of mailing of the international search report

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Goulding, C

# INTERNATIONAL SEARCH REPORT

International Application No  
PCT/SE 96/00555

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>WO,A,93 01659 (MOTOROLA INC) 21 January 1993 see page 36, line 8 - page 37, line 18 -----</p>	1,10,16

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/SE 96/00555

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